

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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Title: METHODS AND APPARATUS  
FOR PULSED DOPING OR  
DRYING A SOOT PREFORM

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Sir:

**BRIEF ON APPEAL**

This Brief supports the appeal to the Board of Patent Appeals and Interferences from the final rejection dated March 9, 2009, in the application listed above. Applicant filed the Notice of Appeal on June 9, 2009, and now submits this Brief.

**I. REAL PARTY IN INTEREST**

The real party in interest in this appeal is Corning Incorporated, which owns the Assignee recorded listed on the Assignment recorded at Reel 013399 and Frame 0472.

**II. RELATED APPEALS AND INTERFERENCES**

With respect to the appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal, there are no such appeals or interferences.

**III. STATUS OF CLAIMS**

Claims 1-3, 7-14, 17-21, 23, 29-30, 32-41, 44-45, 51-53, 56 and 132-140 were rejected in the Final Office Action dated March 9, 2009. Those are the pending claims that are the subject of this Appeal and are set forth in the attached Appendix.

Claims 4-6, 15-16, 22, 24-28, 31, 42-43, 46-50, 54-55, and 57-131 have been cancelled.

**IV. STATUS OF AMENDMENTS**

The Amendment After Final Rejection filed on May 14, 2009 has been entered for purposes of appeal.

**V. SUMMARY OF CLAIMED SUBJECT MATTER**

Claim 1 relates to a method of manufacturing an optical waveguide preform, said method comprising the steps of: providing a first gaseous atmosphere including a first halogen-containing gas to a soot preform contained in a vessel (see, for example, page 3, lines 2-3; page 11, lines 4-7), the first halogen-containing gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); maintaining the first gaseous atmosphere between 1100 and 1300 °C (see, for example, page 15, lines 21-22; page 17, lines 30-32); for a first reacting time sufficient to at least partially dope the soot preform (see, for example, page 2, lines 8-10; page 14, lines 30-32), wherein the first halogen-containing gas has a partial pressure which decreases during the first reacting time (see, for example, page 19, lines 29-32); wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time (see, for example, page 9, lines 24-25; page 12, lines 20-21; page 15, lines 4-5; page 17, lines 22-24), and wherein the first gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the first reacting time (see, for example, page 12, lines 25-26); evacuating at least a portion of the first gaseous atmosphere from the vessel (see, for example, page 2, lines 19-20; page 10, lines 19-20; page 15, lines 28-29); providing the vessel with a second gaseous atmosphere (see, for example, page 2, line 10) including a second halogen-containing gas, the second halogen-containing gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); and

maintaining the second gaseous atmosphere between 1100 and 1300 °C (see, for example, page 16, lines 13-14; page 17, lines 30-32), for a second reacting time sufficient to further dope the soot preform (see, for example, page 2, lines 10-12), wherein the second halogen-containing gas has a partial pressure which decreases during the second reacting time (see, for example, page 19, lines 29-32), and wherein the second gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the second reacting time (see, for example, page 12, lines 25-26); wherein the soot preform is retained in the vessel throughout and between: the step of maintaining the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere, the step of providing the second gaseous atmosphere, and the step of maintaining the second gaseous atmosphere (see, for example, page 16, lines 3-5; page 19, lines 10-12).

Claim 30 relates to a method of manufacturing an optical waveguide preform, said method comprising the steps of: providing a first gaseous atmosphere to a soot preform contained in a vessel (see, for example, page 3, lines 2-3; page 11, lines 4-7), the first gaseous atmosphere including a fluorine-containing gas selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); maintaining the first gaseous atmosphere between 1100 and 1300 °C (see, for example, page 15, lines 21-22; page 17, lines 30-32), for a first reacting time of between about 1 and 60 minutes to at least partially dope the soot preform (see, for example, page 2, lines 16-17; page 13, lines 1-2), wherein the first fluorine-containing gas has a partial pressure which decreases during the first reacting time (see, for example, page 19, lines 29-32), wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time (see, for example, page 9, lines 24-25; page 12, lines 20-21; page 15, lines 4-5; page 17, lines 22-24), and wherein the first gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the first reacting time (see, for example, page 12, lines 25-26); evacuating at least a portion of the first gaseous atmosphere from the vessel at the end of the first reacting time (see, for example, page 2, lines 19-20; page 10, lines 19-20; page 15, lines 28-29); then providing the vessel with a second gaseous atmosphere (see, for example, page 2, line 10), the second gaseous atmosphere including a fluorine-containing gas selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for

example, page 14, lines 9-12; page 16, lines 21-23); and maintaining the second gaseous atmosphere between 1100 and 1300 °C (see, for example, page 16, lines 13-14; page 17, lines 30-32), for a second reacting time sufficient to further dope the soot preform (see, for example, page 2, lines 10-12), wherein the second fluorine-containing gas has a partial pressure which decreases during the second reacting time (see, for example, page 19, lines 29-32), and wherein the second gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the second reacting time (see, for example, page 12, lines 25-26); wherein the soot preform is retained in the vessel throughout and between: the step of maintaining the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere, the step of providing the vessel with the second gaseous atmosphere, and the step of maintaining the second gaseous atmosphere (see, for example, page 16, lines 3-5; page 19, lines 10-12).

Claim 51 recites a method of manufacturing an optical waveguide preform, said method comprising the steps of: flowing a process gas into a vessel to provide a gaseous atmosphere in the vessel about a soot preform (see, for example, page 2, lines 24-26), the process gas including a first gas selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); maintaining the gaseous atmosphere between 1100 and 1300 °C (see, for example, page 15, lines 21-22; page 17, lines 30-32), for a reacting time sufficient to at least partially dope the soot preform (see, for example, page 2, lines 8-10; page 14, lines 30-32), wherein the first gas has a partial pressure which decreases during the reacting time (see, for example, page 19, lines 29-32), wherein no more than 0.5 slpm of the gaseous atmosphere flows out of the vessel during the reacting time (see, for example, page 9, lines 24-25; page 12, lines 20-21; page 15, lines 4-5; page 17, lines 22-24), and wherein the gaseous atmosphere is pressurized about the soot preform to greater than ambient pressure during the reacting time (see, for example, page 12, lines 27-28; page 13, lines 1-2); and evacuating at least a portion of the gaseous atmosphere from the vessel at the end of the reacting time (see, for example, page 2, lines 19-20; page 10, lines 19-20; page 15, lines 28-29).

Claim 132 recites a method of manufacturing an optical waveguide preform, said method comprising the steps of: providing a soot preform contained in a vessel (see,

for example, page 3, lines 2-3; page 11, lines 4-7); adding a quantity of a first gas to the vessel to provide a first gaseous atmosphere to the soot preform, the first gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); maintaining the first gaseous atmosphere between 1100 and 1300 °C (see, for example, page 15, lines 21-22; page 17, lines 30-32), for a first reacting time sufficient to at least partially dope the soot preform (see, for example, page 2, lines 8-10; page 14, lines 30-32), wherein the first gas has a partial pressure which decreases during the first reacting time (see, for example, page 19, lines 29-32), wherein the first gaseous atmosphere is pressurized to a first pressure greater than ambient pressure (see, for example, page 12, lines 27-28; page 13, lines 1-2), and wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time (see, for example, page 9, lines 24-25; page 12, lines 20-21; page 15, lines 4-5; page 17, lines 22-24); then adding a quantity of a second gas to the vessel to provide a second gaseous atmosphere to the soot preform (see, for example, page 2, line 10), the second gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); and maintaining the second gaseous atmosphere between 1100 and 1300 °C (see, for example, page 16, lines 13-14; page 17, lines 30-32), for a second reacting time sufficient to at least partially dope the soot preform (see, for example, page 2, lines 10-12), wherein the second gas has a partial pressure which decreases during the second reacting time (see, for example, page 19, lines 29-32), wherein the second gaseous atmosphere is pressurized to a second pressure greater than ambient pressure (see, for example, page 12, lines 27-28; page 13, lines 1-2), and wherein no more than 0.5 slpm of the second gaseous atmosphere flows out of the vessel during the second reacting time (see, for example, page 9, lines 24-25; page 12, lines 20-21; page 15, lines 4-5; page 17, lines 22-24); wherein the soot preform is retained in the vessel throughout and between the step of adding a quantity of a first gas, the step of maintaining the first gaseous atmosphere, the step of adding a quantity of a second gas, and the step of maintaining the second gaseous atmosphere (see, for example, page 16, lines 3-5; page 19, lines 10-12).

Claim 139 recites a method of manufacturing an optical waveguide preform, said method comprising the steps of: providing a soot preform contained in a vessel (see, for

example, page 3, lines 2-3; page 11, lines 4-7); adding a quantity of a first fluorine-containing gas to the vessel to provide a first gaseous atmosphere to the soot preform, the first gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); then, sealing the vessel gas-tight and maintaining the first gaseous atmosphere between 1100 and 1300 °C (see, for example, page 15, lines 21-22; page 17, lines 30-32), for a first reacting time sufficient to dope the soot preform (see, for example, page 2, lines 8-10; page 14, lines 30-32), wherein the first gas has a partial pressure which decreases during the first reacting time as the soot preform is doped (see, for example, page 19, lines 29-32), wherein the first gaseous atmosphere is pressurized to a first pressure greater than ambient pressure during the first reacting time (see, for example, page 12, lines 27-28; page 13, lines 1-2); then, evacuating at least a portion of the first gaseous atmosphere from the vessel (see, for example, page 2, lines 19-20; page 10, lines 19-20; page 15, lines 28-29); then, adding a quantity of a second fluorine-containing gas to the vessel to provide a second gaseous atmosphere to the soot preform (see, for example, page 2, line 10), the second gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); then, sealing the vessel gas-tight and maintaining the soot preform in contact with the second gaseous atmosphere within the vessel (see, for example, page 17, lines 16-17), and maintaining the second gaseous atmosphere between 1100 and 1300 °C (see, for example, page 16, lines 13-14; page 17, lines 30-32), for a second reacting time sufficient to further dope the soot preform (see, for example, page 2, lines 10-12), wherein the second gas has a partial pressure which decreases during the second reacting time as the soot preform is doped (see, for example, page 19, lines 29-32), wherein the second gaseous atmosphere is pressurized to a second pressure greater than ambient pressure during the second reacting time (see, for example, page 12, lines 27-28; page 13, lines 1-2); wherein the soot preform is retained in the vessel throughout and between the step of adding a quantity of a first fluorine-containing gas, the step of sealing the vessel gas-tight and maintaining the soot preform in contact with the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere from the vessel, the step of adding a quantity of a second fluorine-containing gas, and the step of sealing the vessel gas-tight and maintaining the soot preform

in contact with the second gaseous atmosphere (see, for example, page 16, lines 3-5; page 19, lines 10-12).

Claim 140 recites a method of manufacturing an optical waveguide preform, said method comprising the steps of: providing a soot preform contained in a vessel (see, for example, page 3, lines 2-3; page 11, lines 4-7); adding a quantity of a first fluorine-containing gas to the vessel and in contact with the soot preform to provide a first gaseous atmosphere to the soot preform, the first gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); then, interrupting the adding of the first fluorine-containing gas into the vessel and maintaining the soot preform in contact with the first gaseous atmosphere within the vessel (see, for example, page 11, lines 17-22), and maintaining the first gaseous atmosphere between 1100 and 1300 °C (see, for example, page 15, lines 21-22; page 17, lines 30-32), for a first reacting time sufficient to dope the soot preform (see, for example, page 2, lines 8-10; page 14, lines 30-32), wherein the first gas has a partial pressure which decreases during the first reacting time as the soot preform is doped (see, for example, page 19, lines 29-32), wherein the first gaseous atmosphere is pressurized to a first pressure greater than ambient pressure during the first reacting time (see, for example, page 12, lines 27-28; page 13, lines 1-2); then, evacuating at least a portion of the first gaseous atmosphere from the vessel (see, for example, page 2, lines 19-20; page 10, lines 19-20; page 15, lines 28-29); then, adding a quantity of a second fluorine-containing gas to the vessel to provide a second gaseous atmosphere to the soot preform (see, for example, page 2, line 10), the second gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> (see, for example, page 14, lines 9-12; page 16, lines 21-23); then, interrupting the adding of the second fluorine-containing gas into the vessel and maintaining the soot preform in contact with the second gaseous atmosphere within the vessel (see, for example, page 11, lines 17-22), and maintaining the second gaseous atmosphere between 1100 and 1300 °C (see, for example, page 16, lines 13-14; page 17, lines 30-32), for a second reacting time sufficient to further dope the soot preform (see, for example, page 2, lines 10-12), wherein the second gas has a partial pressure which decreases during the second reacting time as the soot preform is doped (see, for example, page 19, lines 29-32), wherein the second gaseous atmosphere is

pressurized to a second pressure greater than ambient pressure during the second reacting time (see, for example, page 12, lines 27-28; page 13, lines 1-2); wherein the soot preform is retained in the vessel throughout and between the step of adding a quantity of a first fluorine-containing gas, the step of interrupting the adding of the first fluorine-containing gas and maintaining the soot preform in contact with the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere from the vessel, the step of adding a quantity of a second fluorine-containing gas, and the step of interrupting the adding of the second fluorine-containing gas and maintaining the soot preform in contact with the second gaseous atmosphere (see, for example, page 16, lines 3-5; page 19, lines 10-12).

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

Issues presented for consideration in this Appeal are:

Whether the rejection of claims 1-3, 7-14, 17-21, 23, 29-30, 32-41, 44-45, 51-53, 56 and 132-140 under 35 U.S.C. 103(a) as being unpatentable over Kyoto (US Patent No. 5,158,587) alone, or in view of Walker (US Patent No. 4,178,347), Dobbins (US Patent No. 5,043,002), Biswas (US Patent No. 4,575,463), Simms (US Patent No. 4,339,256) and Korenowski (US Patent No. 4,118,295) is proper.

## **VII. ARGUMENTS**

The rejection of claims 1-3, 7-14, 17-21, 23, 29-30, 32-41, 44-45, 51-53, 56 and 132-140 under 35 U.S.C. 103(a) as being unpatentable over Kyoto (US Patent No. 5,158,587) alone, or in view of Walker (US Patent No. 4,178,347), Dobbins (US Patent No. 5,043,002), Biswas (US Patent No. 4,575,463), Simms (US Patent No. 4,339,256) and Korenowski (US Patent No. 4,118,295) is improper.

In the final Office Action of March 9, 2009, the Examiner rejected pending claims 1-3, 7-14, 17-21, 23, 29-30, 32-41, 44, 45, 51-53, 56, and 132-140 under 35 U.S.C. § 103 as being unpatentable over “Kyoto 5158587 alone, or in view of Walker 4178347, Dobbins 5043002, Biswas 4575463 Simms 4339256 and Korenowski 4118295.” In the final Office Action, the Examiner stated “Example 2 of Kyoto discloses the providing step and all of the contacting step, except for the flow rate limitation and the decreasing partial pressure.

Kyoto's example 2 also does not disclose the evacuating and refilling. However, based on col. 2, line 63 and example 1, Kyoto also teaches doping without any gas flowing out. Alternatively, it would have been obvious to have no gas flowing out, because if any gas flows out, the pressure is not being maintained." (Final Office Action, page 3). The Examiner continued by noting that "in light of col. 3, lines 14-24 of Walker, the gas is corrosive and noxious – which provides motivation to use the not-preferred method – i.e. to create less corrosive and noxious gas. See also Dobbins col. 1, line 37 to col. 2, line 44 which discloses that use of halides can be very expensive in terms of pollution abatement and equipment loss." (*Id.*, pages 3-4). In addition, the Examiner stated that "it is inherent that the partial pressure would decrease – clearly, since the fluorine is doped into the glass, the amount of fluorine in the gas would be reduced, which would cause the partial pressure to decrease." (*Id.*, page 4). The Examiner also stated that "[a]s to the evacuating and refilling, it would have been obvious to purge the gas, and refill it so to provide more fluorine. It is generally not invention to replenish a spent source. See for example Biswas (col. 4, lines 11-15)." (*Id.*) The Examiner further stated that "a continuous process is obvious in view of a batch process" and "[d]ividing the amount of necessary fluorine into two separate steps would have been *prima facie* obvious. It does not appear to be any more innovative than providing dual rinse cycles, or dual wash cycles in a dishwasher or clothes washer." (*Id.*, pages 4-5). The Examiner additionally noted that "Simms is cited as evidence that batch semicontinuous and continuous processes are known in the glass making art (col. 5, lines 8-13). Korenowski is cited to show that it is known that semi-continuous processes are sometimes the most economical (col. 3, lines 23-27). Thus in addition to the above: it would have been obvious to try to add the dopant gas in a semi continuous manner – or otherwise provide the dopant in two phases, rather than in one step, or in a continuous manner, to find the most effective way of minimizing the noxious/corrosive gas." (*Id.*, page 5).

Claim 1 recites, *inter alia*, "maintaining the first gaseous atmosphere between 1100 and 1300 °C, for a first reacting time sufficient to at least partially dope the soot preform, wherein the first halogen-containing gas has a partial pressure which decreases during the first reacting time, wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time, and wherein the first gaseous atmosphere is pressurized

to a gage pressure of at least 0.1 atm gage during the first reacting time . . . .” Each of the other independent claims, 30, 51, 132, 139 and 140 recite a first gas that has a partial pressure that decreases during the first reacting time and that the first gaseous atmosphere is pressurized to a positive gage pressure or above ambient pressure.

Applicants submit that the Examiner has not made out a *prima facie* case of obviousness with respect to claim 1 or any of the other independent claims. In the final Office Action, the Examiner argued that Kyoto alone establishes a *prima facie* case of obviousness because Kyoto inherently results in the recitation that the “first halogen-containing gas has a partial pressure which decreases during the first reacting time.” Specifically, the Examiner noted, “the rejection also does make a reasonable case that Kyoto (alone) establishes inherency . . . Since the gas does not flow out, and since fluorine is leaving the gas and entering the preform, there are fewer atoms of fluorine in the gas thus the partial pressure would necessarily/inherently decrease.” (Final Office Action, page 8).

Applicants respectfully disagree. As stated in the MPEP, “To establish inherency, the extrinsic evidence ‘must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.’” (MPEP § 2112, citing *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)).

In arguing that Kyoto inherently meets claim 1, the Examiner points to Example 1 and col. 2, line 63 of Kyoto. However, neither of these portions of Kyoto results in a partial pressure of a first halogen-containing gas that decreases during a first or a second reaction time. Example 1 of Kyoto states that “a pure silica soot preform was heated in the vessel 3 containing pure SiF<sub>4</sub> under pressure of 4 atm. at 1,100° C. for 2 hours . . . .” (Kyoto, col. 4, ll. 16-18). Thus, contrary to the Examiner’s assertion, Example 1 indicates that the pressure of pure SiF<sub>4</sub> was maintained at 4 atm for 2 hours. Nothing in this example indicates that the pressure of SiF<sub>4</sub> was allowed to decrease, let alone that the pressure of SiF<sub>4</sub> in the vessel would necessarily decrease as a result of practicing this example.

Similarly, col. 2, line 62 of Kyoto merely states that “[p]referably, SiF<sub>4</sub> is flowed into the atmosphere.” Even assuming *arugendo* that this statement can be construed as contemplating embodiments wherein SiF<sub>4</sub> is and is not flowed into the atmosphere, such does not establish a *prima facie* case of inherency. Specifically, regardless of whether SiF<sub>4</sub> is flowed into the atmosphere, such would not necessarily result in a partial pressure of a first halogen-containing gas that decreases during a first or a second reaction time. In any such event, a compensating amount of SiF<sub>4</sub> gas can be added to the reaction vessel such that the partial pressure of SiF<sub>4</sub> at least remains constant.

In fact, continuously adding a compensating amount of SiF<sub>4</sub> so as to maintain a constant partial pressure of SiF<sub>4</sub> (and a constant reaction rate) is precisely what Kyoto consistently and repeatedly teaches (see, e.g., Kyoto, col. 4, ll. 30-32 (“porous silica glass deposited around the core was heated at 1,100°C under 2 atm. for one hour with flowing SiF<sub>4</sub> at a rate of 2 l/min); col. 3, ll. 43-44 (“By continuously providing fresh SiF<sub>4</sub> in the vessel an optimum reaction rate can be maintained.”); col. 4, ll. 48-51 (“When SiF<sub>4</sub> is continuously flowed during the addition of fluorine to the porous soot preform, the reaction rate of fluorine is not decreased and less bubbles are formed in the preform.”)).

Nonetheless, the Examiner argues that Kyoto’s teachings regarding continuously flowing fresh SiF<sub>4</sub> merely constitute preferred embodiments, whereafter the Examiner cites MPEP § 2123 regarding the prior art effect of disclosed but nonpreferred embodiments. However, this section (and the cases cited therein) presupposes that there is a disclosed but not preferred embodiment from which to base the rejection. Here, no such embodiment has been provided. Specifically, the Examiner has not shown that any embodiment of Kyoto teaches or necessarily results in a partial pressure of a first halogen-containing gas that decreases during a first or second reaction time.

Moreover, persons having ordinary skill in the art would not have been motivated to modify Kyoto to provide for this recitation. In particular, motivation of Kyoto to provide for a partial pressure of a first halogen-containing gas that decreases during a first or second reaction time would render Kyoto unsatisfactory for its intended purpose because Kyoto teaches that a constant partial pressure of SiF<sub>4</sub> (and constant reaction rate) is to be maintained during reaction (i.e., not decreased) by continuously flowing SiF<sub>4</sub> to the reaction vessel (*see*,

*e.g.*, Kyoto, col. 3, ll. 43-44; col. 4, ll. 48-51). “If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.” (MPEP § 2143.01 (citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)).

In response to Applicants’ arguments that no motivation has been provided to modify the teachings of Kyoto to provide for decreasing the partial pressure of a halogen-containing gas during a reacting time, the Examiner noted, “[i]t is also argued that the relevant issue is whether there is motivation to modify Kyoto to allow the decrease of the partial pressure. Applicant concludes there is no motivation because it . . . would make the process unsatisfactory for its intended purpose. Examiner cannot agree at least because Applicant has not pointed out any intended purpose and why the modification would make the process unsatisfactory. It seems clear to Examiner the purpose is to dope the preform. This purpose would clearly result from the proposed modification.” (Final Office Action, page 10).

Applicants reiterate that modification of Kyoto to provide for decreasing partial pressure of a halogen-containing gas during reaction would render Kyoto unsatisfactory for its intended purpose because Kyoto teaches that an intended purpose of his invention “is to provide a method for producing a glass preform containing fluorine in an increased amount with fewer or no bubbles therein.” (Kyoto, col. 2, ll. 45-48). Kyoto teaches that this object is achieved by maintaining a constant or non-decreasing reaction rate, which in turn is achieved by maintaining a constant or non-decreasing amount of SiF<sub>4</sub> reactant in the reaction vessel (*see e.g.*, Kyoto, col. 4, ll. 48-51 (“When SiF<sub>4</sub> is continuously flowed during the addition of fluorine to the porous soot preform, the reaction rate of fluorine is not decreased and less bubbles are formed in the preform.”); *see also* Kyoto, col. 3, ll. 43-50). Accordingly, modification of Kyoto to allow the partial pressure of SiF<sub>4</sub> to decrease during reaction would lead to a decrease in the reaction rate at constant temperature, resulting in an increase in bubbles formed in the preform, thereby rendering Kyoto unsatisfactory for its intended purpose.

In addition to failing to teach or suggest a partial pressure of a first halogen-containing gas that decreases during a first or second reaction time, several other limitations of independent claim 1 (and other independent claims) are not taught or suggested by any

embodiment of Kyoto. For example, Kyoto fails to teach or suggest that no more than 0.5 slpm of a first gaseous atmosphere flows out of a vessel during a first reacting time. In addition, Kyoto fails to teach or suggest evacuating at least a portion of a first gaseous atmosphere from a vessel. Moreover, Kyoto does not teach or suggest providing a vessel with a second gaseous atmosphere including a second halogen-containing gas nor does it teach that the second halogen-containing gas has a partial pressure which decreases during the second reacting time. Accordingly, at least this combination of steps outside of the disclosure of Kyoto would be required in order to meet the recitation of, e.g., claim 1.

Applicants further submit that persons having ordinary skill in the art would not have been motivated to combine any of the secondary references with Kyoto in order to obtain the claimed invention. Walker relates to entirely non-analogous art (“the simultaneous manufacture of wet process phosphoric acid and sodium silico-fluoride”) and the cited portion of Walker relates to the elimination of moisture into an atmosphere containing SiF<sub>4</sub> gas and not the reduction of SiF<sub>4</sub> gas itself (*see*, Walker col. 3, ll. 14-26). Dobbins also relates to non-analogous art (“the replacement of SiCl<sub>4</sub> in vapour deposition processes with a halide-free, silica-source compound, thus greatly reducing, if not eliminating, the production of HCl.”) and use of a halide-free source as taught by Dobbins (i.e., complete replacement of a halide-containing reactant) would render Kyoto unsatisfactory for its intended purpose because Kyoto specifically emphasizes the use of SiF<sub>4</sub>.

In addition, persons having ordinary skill in the art would not be motivated to evacuate at least a portion of a first gaseous atmosphere from a vessel and then provide the vessel with a second gaseous atmosphere in view of Biswas. Biswas relates to the application of a primary and secondary coating on an already drawn optical fiber and does not teach or suggest providing a first gaseous atmosphere to a vessel, at least partially evacuating the first gaseous atmosphere from the vessel, and then providing a second gaseous atmosphere to the vessel.

Persons having ordinary skill in the art would also not be motivated to modify the teachings of Kyoto in view of Simms or Korenowski. Simms relates to the non-analogous art of making ophthalmic polarized glass for sunglass lenses and Korenowski relates to the non-

analogous art of regenerating mixtures of chromic and sulphuric acids that are used for etching plastics prior to metallic plating.

Accordingly, Applicants submit that independent claims 1, 30, 51, 132, 139, and 140 are patentable over the cited references. Applicants further submit that all claims depending from these claims are patentable over the cited references.

Moreover, Applicants submit that claim 18 ("increasing a total pressure of the first gaseous atmosphere in the vessel during the first reacting time") is patentable over the cited references for at least the reasons discussed above and for the additional reason that Kyoto does not teach or suggest increasing a total pressure of the first gaseous atmosphere in the vessel during the first reaction time as alleged by the Examiner (because of the inclusion of equation 2 in Kyoto's specification). Instead, Kyoto teaches away from the reaction set forth in equation 2 (Kyoto, col. 3, ll. 43-47 ("By continuously providing fresh SiF<sub>4</sub> in the vessel an optimum reaction rate can be maintained. This may be due to the fact that the dissociation reaction represented by the following reaction formula (2) could be suppressed.")).

### CONCLUSION

In conclusion, Applicant requests a reversal of each of the grounds of rejection maintained by the Examiner.

The Office is authorized to charge the fees due in connection with the filing of this Brief on Appeal to our Deposit Account No. 03-3325. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such an extension is requested and the fee should also be charged to our Deposit Account.

Respectfully submitted,

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## VIII. CLAIMS APPENDIX TO BRIEF ON APPEAL

The claims on appeal are as follows:

1. **(rejected)** A method of manufacturing an optical waveguide preform, said method comprising the steps of:

providing a first gaseous atmosphere including a first halogen-containing gas to a soot preform contained in a vessel, the first halogen-containing gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>;

maintaining the first gaseous atmosphere between 1100 and 1300 °C, for a first reacting time sufficient to at least partially dope the soot preform, wherein the first halogen-containing gas has a partial pressure which decreases during the first reacting time, wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time, and wherein the first gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the first reacting time;

evacuating at least a portion of the first gaseous atmosphere from the vessel;

providing the vessel with a second gaseous atmosphere including a second halogen-containing gas, the second halogen-containing gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>; and

maintaining the second gaseous atmosphere between 1100 and 1300 °C, for a second reacting time sufficient to further dope the soot preform, wherein the second halogen-containing gas has a partial pressure which decreases during the second reacting time, and wherein the second gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the second reacting time;

wherein the soot preform is retained in the vessel throughout and between: the step of maintaining the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere, the step of providing the second gaseous atmosphere, and the step of maintaining the second gaseous atmosphere.

2. **(rejected)** The method of Claim 1 further including, following said step of maintaining second gaseous atmosphere:

providing the vessel with a third gaseous atmosphere including a third halogen-containing gas; and

maintaining the third gaseous atmosphere in the vessel for a third reacting time sufficient to further dope the soot preform, wherein the third halogen-containing gas has a partial pressure which decreases during the third reacting time, wherein the soot preform is retained in the vessel throughout and between: the step of maintaining the second gaseous atmosphere, the step of providing the third gaseous atmosphere, and the step of maintaining the third gaseous atmosphere.

3. **(rejected)** The method of Claim 1 including depressurizing the first gaseous atmosphere about the soot preform at the end of the first reacting time.

4. **(cancelled)**

5. **(cancelled)**

6. **(cancelled)**

7. **(rejected)** The method of Claim 1 wherein an inert gas is added to the atmosphere in the vessel during and between said steps of maintaining the first gaseous atmosphere and maintaining the second gaseous atmosphere.

8. **(rejected)** The method of Claim 1 wherein a fluorine-containing gas selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub> is added to the atmosphere in the vessel during at least one of the first and second reacting times.

9. **(rejected)** The method of Claim 1 further including the step of at least partially purging the vessel prior to said step of providing the vessel with the second gaseous atmosphere.

10. **(rejected)** The method of Claim 1 wherein:  
additional dopant gas is added to the atmosphere in the vessel during at least one of the first and second reacting times to compensate for the decreases in the partial pressure of the dopant gas resulting from reaction of the dopant gas with the soot preform.

11. **(rejected)** The method of Claim 1 including pressurizing an outer surface of the vessel to offset pressurization within the vessel.

12. **(rejected)** The method of Claim 1 including supporting a reinforcing sleeve about the vessel during at least the first and second reacting times.

13. **(rejected)** The method of Claim 1 including rotating the soot preform relative to the vessel and wherein the vessel is sealed.

14. **(rejected)** The method of Claim 1 including:  
drying the soot preform prior to said step of providing the first gaseous atmosphere;  
and  
sintering the soot preform following the second reacting time.

15. **(cancelled)**

16. **(cancelled)**

17. **(rejected)** The method of Claim 1 including:  
wherein the first gaseous atmosphere has a first pressure during the first reacting time;  
and  
wherein the second gaseous atmosphere has a second pressure during the second reacting time;  
wherein the second pressure is different than the first pressure.

18. **(rejected)** The method of Claim 1 including increasing a total pressure of the first gaseous atmosphere in the vessel during the first reacting time.

19. **(rejected)** The method of Claim 1 wherein the first reacting time is between about 1 and 60 minutes.

20. **(rejected)** The method of Claim 1 wherein the second reacting time is between about 1 and 60 minutes.

21. **(rejected)** The method of Claim 1 wherein the second reacting time is longer than the first reacting time.

22. **(cancelled)**

23. **(rejected)** The method of Claim 1 wherein the temperature of the second gaseous atmosphere is different than the temperature of the first gaseous atmosphere.

24. **(cancelled)**

25. **(cancelled)**

26. **(cancelled)**

27. **(cancelled)**

28. **(cancelled)**

29. **(rejected)** The method of Claim 1 wherein the first and second gaseous atmospheres each include an inert gas selected from the group consisting of He, Ar, Ne, and N<sub>2</sub>.

30. **(rejected)** A method of manufacturing an optical waveguide preform, said method comprising the steps of:

providing a first gaseous atmosphere to a soot preform contained in a vessel, the first gaseous atmosphere including a fluorine-containing gas selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>;

maintaining the first gaseous atmosphere between 1100 and 1300 °C, for a first reacting time of between about 1 and 60 minutes to at least partially dope the soot preform, wherein the first fluorine-containing gas has a partial pressure which decreases during the first reacting time, wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time, and wherein the first gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the first reacting time;

evacuating at least a portion of the first gaseous atmosphere from the vessel at the end of the first reacting time; then

providing the vessel with a second gaseous atmosphere, the second gaseous atmosphere including a fluorine-containing gas selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>; and

maintaining the second gaseous atmosphere between 1100 and 1300 °C, for a second reacting time sufficient to further dope the soot preform, wherein the second fluorine-containing gas has a partial pressure which decreases during the second reacting time, and wherein the second gaseous atmosphere is pressurized to a gage pressure of at least 0.1 atm gage during the second reacting time;

wherein the soot preform is retained in the vessel throughout and between: the step of maintaining the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere, the step of providing the vessel with the second gaseous atmosphere, and the step of maintaining the second gaseous atmosphere .

31. **(cancelled)**

32. **(rejected)** The method of Claim 30 including the step of depressurizing the first gaseous atmosphere about the soot preform at the end of the first reacting time.

33. **(rejected)** The method of Claim 32 wherein the vessel is substantially completely gas-sealed throughout both of said steps of maintaining the first and second gaseous atmospheres.

34. (rejected) The method of Claim 32 further including, following said step of depressurizing the doping atmosphere, the steps of:

replacing at least a portion of the first gaseous atmosphere with a second gaseous atmosphere about the soot preform, the second gaseous atmosphere being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>; and

pressurizing the second gaseous atmosphere about the soot preform, and maintaining the second gaseous atmosphere between 1100 and 1300 °C, for a second reacting time of no more than 60 minutes to further dope the soot preform.

35. (rejected) The method of Claim 34 wherein said step of pressurizing the second gaseous atmosphere includes pressurizing the second gaseous atmosphere to a gage pressure of at least 0.1 atm.

36. (rejected) The method of Claim 35 wherein said step of pressurizing the second gaseous atmosphere includes pressurizing the second gaseous atmosphere to a gage pressure of at least 0.5 atm.

37. (rejected) The method of Claim 34 wherein the second reacting time is between about 5 and 30 minutes.

38. (rejected) The method of Claim 34 wherein said step of pressurizing the second gaseous atmosphere includes heating the second gaseous atmosphere to a temperature of between about 1125 and 1300 °C.

39. (rejected) The method of Claim 30 including pressurizing an outer surface of the vessel to offset the pressurizing within the vessel.

40. (rejected) The method of Claim 30 including rotating the soot preform relative to the vessel.

41. (rejected) The method of Claim 30 including:  
drying the soot preform prior to said step of providing the first gaseous atmosphere;  
and  
sintering the soot preform following the first reacting time.

42. (cancelled)

43. (cancelled)

44. (rejected) The method of Claim 30 wherein the first gaseous atmosphere has  
a gage pressure of at least 0.5 atm gage.

45. (rejected) The method of Claim 30 wherein the first reacting time is between  
about 5 and 30 minutes.

46. (cancelled)

47. (cancelled)

48. (cancelled)

49. (cancelled)

50. (cancelled)

51. (rejected) A method of manufacturing an optical waveguide preform, said  
method comprising the steps of:

flowing a process gas into a vessel to provide a gaseous atmosphere in the vessel  
about a soot preform, the process gas including a first gas selected from the group consisting  
of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>;

maintaining the gaseous atmosphere between 1100 and 1300 °C, for a reacting time  
sufficient to at least partially dope the soot preform, wherein the first gas has a partial

pressure which decreases during the reacting time, wherein no more than 0.5 slpm of the gaseous atmosphere flows out of the vessel during the reacting time, and wherein the gaseous atmosphere is pressurized about the soot preform to greater than ambient pressure during the reacting time; and

evacuating at least a portion of the gaseous atmosphere from the vessel at the end of the reacting time.

52. **(rejected)** The method of claim 51 further including flowing a makeup gas into the vessel during the reacting time.

53. **(rejected)** The method of claim 52 wherein the flow rate of the makeup gas is provided to at least partially offset for any pressure loss due to the first gas reacting with the preform.

54. **(cancelled)**

55. **(cancelled)**

56. **(rejected)** The method of claim 51 including flowing an additional amount of the process gas into the vessel to form a second gaseous atmosphere in the vessel about the soot preform following said step of evacuating at least a portion of the gaseous atmosphere from the vessel, wherein the soot preform is retained in the vessel throughout and between the step of flowing the process gas into the vessel, the step of maintaining the gaseous atmosphere, the step of evacuating at least a portion of the gaseous atmosphere, and the step of flowing an additional amount of the process gas into the vessel.

57. – 131 **(cancelled)**

132. **(rejected)** A method of manufacturing an optical waveguide preform, said method comprising the steps of:

providing a soot preform contained in a vessel;

adding a quantity of a first gas to the vessel to provide a first gaseous atmosphere to the soot preform, the first gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>;

maintaining the first gaseous atmosphere between 1100 and 1300 °C, for a first reacting time sufficient to at least partially dope the soot preform, wherein the first gas has a partial pressure which decreases during the first reacting time, wherein the first gaseous atmosphere is pressurized to a first pressure greater than ambient pressure, and wherein no more than 0.5 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time; then

adding a quantity of a second gas to the vessel to provide a second gaseous atmosphere to the soot preform, the second gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>; and

maintaining the second gaseous atmosphere between 1100 and 1300 °C, for a second reacting time sufficient to at least partially dope the soot preform, wherein the second gas has a partial pressure which decreases during the second reacting time, wherein the second gaseous atmosphere is pressurized to a second pressure greater than ambient pressure, and wherein no more than 0.5 slpm of the second gaseous atmosphere flows out of the vessel during the second reacting time;

wherein the soot preform is retained in the vessel throughout and between the step of adding a quantity of a first gas, the step of maintaining the first gaseous atmosphere, the step of adding a quantity of a second gas, and the step of maintaining the second gaseous atmosphere.

133. **(rejected)** The method of claim 132 wherein the vessel is sealed gas-tight throughout the first reacting time.

134. **(rejected)** The method of claim 133 wherein the vessel is sealed gas-tight throughout the second reacting time.

135. **(rejected)** The method of claim 132 wherein at least a portion of the first gaseous atmosphere is evacuated from the vessel at the end of the first reacting time.

136. **(rejected)** The method of claim 132 wherein at least a portion of the second gaseous atmosphere is evacuated from the vessel at the end of the second reacting time.

137. **(rejected)** The method of claim 132 wherein no more than 0.1 slpm of the first gaseous atmosphere flows out of the vessel during the first reacting time.

138. **(rejected)** The method of claim 132 wherein no more than 0.1 slpm of the second gaseous atmosphere flows out of the vessel during the second reacting time.

139. **(rejected)** A method of manufacturing an optical waveguide preform, said method comprising the steps of:

providing a soot preform contained in a vessel;  
adding a quantity of a first fluorine-containing gas to the vessel to provide a first gaseous atmosphere to the soot preform, the first gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>; then,

sealing the vessel gas-tight and maintaining the first gaseous atmosphere between 1100 and 1300 °C, for a first reacting time sufficient to dope the soot preform, wherein the first gas has a partial pressure which decreases during the first reacting time as the soot preform is doped, wherein the first gaseous atmosphere is pressurized to a first pressure greater than ambient pressure during the first reacting time; then,

evacuating at least a portion of the first gaseous atmosphere from the vessel; then,  
adding a quantity of a second fluorine-containing gas to the vessel to provide a second gaseous atmosphere to the soot preform, the second gas being selected from the group consisting of SiF<sub>4</sub>, SF<sub>6</sub>, CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, COF<sub>2</sub>, C<sub>2</sub>F<sub>2</sub>Cl<sub>2</sub>, and F<sub>2</sub>; then,

sealing the vessel gas-tight and maintaining the soot preform in contact with the second gaseous atmosphere within the vessel, and maintaining the second gaseous atmosphere between 1100 and 1300 °C, for a second reacting time sufficient to further dope the soot preform, wherein the second gas has a partial pressure which decreases during the second reacting time as the soot preform is doped, wherein the second gaseous atmosphere is

pressurized to a second pressure greater than ambient pressure during the second reacting time;

wherein the soot preform is retained in the vessel throughout and between the step of adding a quantity of a first fluorine-containing gas, the step of sealing the vessel gas-tight and maintaining the soot preform in contact with the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere from the vessel, the step of adding a quantity of a second fluorine-containing gas, and the step of sealing the vessel gas-tight and maintaining the soot preform in contact with the second gaseous atmosphere.

140. (rejected) A method of manufacturing an optical waveguide preform, said method comprising the steps of:

providing a soot preform contained in a vessel;  
adding a quantity of a first fluorine-containing gas to the vessel and in contact with the soot preform to provide a first gaseous atmosphere to the soot preform, the first gas being selected from the group consisting of  $\text{SiF}_4$ ,  $\text{SF}_6$ ,  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{COF}_2$ ,  $\text{C}_2\text{F}_2\text{Cl}_2$ , and  $\text{F}_2$ ; then,

interrupting the adding of the first fluorine-containing gas into the vessel and maintaining the soot preform in contact with the first gaseous atmosphere within the vessel, and maintaining the first gaseous atmosphere between 1100 and 1300 °C, for a first reacting time sufficient to dope the soot preform, wherein the first gas has a partial pressure which decreases during the first reacting time as the soot preform is doped, wherein the first gaseous atmosphere is pressurized to a first pressure greater than ambient pressure during the first reacting time; then,

evacuating at least a portion of the first gaseous atmosphere from the vessel; then,  
adding a quantity of a second fluorine-containing gas to the vessel to provide a second gaseous atmosphere to the soot preform, the second gas being selected from the group consisting of  $\text{SiF}_4$ ,  $\text{SF}_6$ ,  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{COF}_2$ ,  $\text{C}_2\text{F}_2\text{Cl}_2$ , and  $\text{F}_2$ ; then,

interrupting the adding of the second fluorine-containing gas into the vessel and maintaining the soot preform in contact with the second gaseous atmosphere within the vessel, and maintaining the second gaseous atmosphere between 1100 and 1300 °C, for a second reacting time sufficient to further dope the soot preform, wherein the second gas has a partial pressure which decreases during the second reacting time as the soot preform is doped,

wherein the second gaseous atmosphere is pressurized to a second pressure greater than ambient pressure during the second reacting time;

wherein the soot preform is retained in the vessel throughout and between the step of adding a quantity of a first fluorine-containing gas, the step of interrupting the adding of the first fluorine-containing gas and maintaining the soot preform in contact with the first gaseous atmosphere, the step of evacuating at least a portion of the first gaseous atmosphere from the vessel, the step of adding a quantity of a second fluorine-containing gas, and the step of interrupting the adding of the second fluorine-containing gas and maintaining the soot preform in contact with the second gaseous atmosphere.

**IX. EVIDENCE APPENDIX**

None

**X. RELATED PROCEEDINGS APPENDIX**

None